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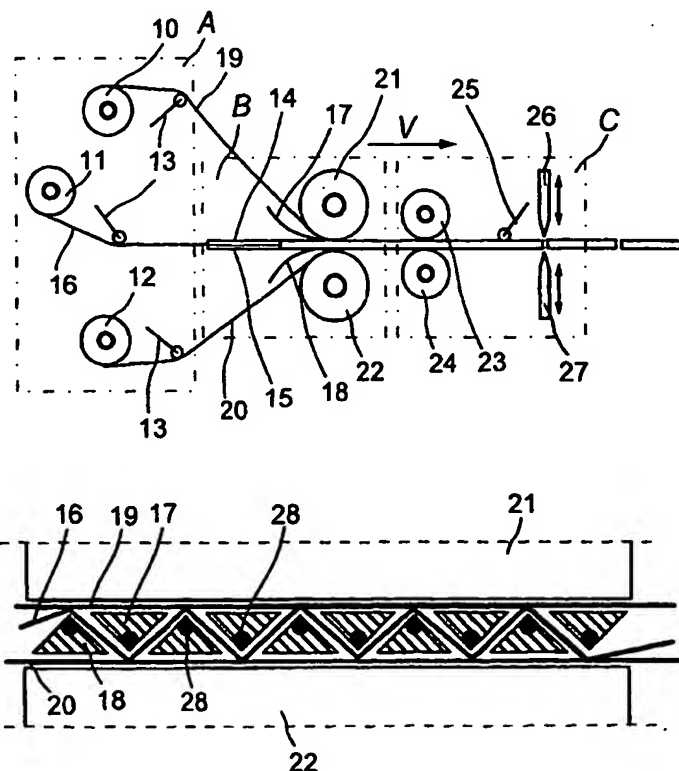
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(54) Title: METHOD AND DEVICE FOR THE MANUFACTURE OF CORRUGATED MATERIAL



(57) Abstract: Method and device for the manufacture of corrugated material, at least one first plane sheet (19; 20) and one second sheet (16) of plastic material arranged in wave shape being brought together for adhesion to each other and the wave-shaped sheet (16) running over core bars (17, 18). A portion of at least one sheet is heated at abutment against the core bars (17, 18) and the first sheet (19; 20) is brought to abutment against the second sheet (16) for welding the sheets (16; 19, 20) together. First members are arranged for feeding at least the first plane sheet and the second sheet of plastic material running over core bars (17, 18) and second members are arranged for bringing together and adhering the sheets. Heating members (28) are arranged for transferring heat to a portion of at least one sheet (16; 19, 20) abutting against the core bars and including plastic material. Furthermore, guide members (17, 18; 21; 22) are arranged for bringing together the first and the second sheet in an abutment portion and for welding in the portion heated by the heating members (28).

WO 01/08878 A1

WO 01/08878 A1



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METHOD AND DEVICE FOR THE MANUFACTURE OF CORRUGATED
MATERIAL

FIELD OF THE INVENTION

5

The invention relates to a method and a device for the manufacture of corrugated material, at least one first plane sheet and one second sheet of plastic material arranged in wave shape being brought together for adhesion to each other and the wave-shaped sheet running over core bars. First mem-
bers are arranged for feeding at least one plane sheet and one second sheet
of plastic material running over the core bars and second members are
arranged for bringing together and adhering the sheets.

PRIOR ART

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Since long, different forms of corrugated board have been manufactured and used, above all for packing and the like. Corrugated board has very good insulating and shock-absorbing properties, but it is also impaired by a plurality of disadvantages. The largest disadvantage is, perhaps, the
bad moist-resistance thereof. When corrugated board becomes damp, it
looses a large part of the supporting capacity and durability thereof.

It is also known, per se, to form sheets of plastic material to wave shape and connect such wave-shaped sheets with plane sheets of similar material. An example of this is shown and described in US-A-4897146. The
sheet that is to be wave-shaped is heated by particular heating members, making the material plastic. The material is then formed to wave shape with core bars and one side of the wave-shaped material is pressed against a pre-heated plane sheet by a forming drum, which is made with recesses being ring-shaped and adapted to the core bars. An additional plane sheet is
heated in the similar way and is pressed against the other side of the wave-shaped material by a second preferably cooled drum.

The material that the sheets are made of is relatively stiff and the thickness of the sheets is such that at least the sheet that is to be wave-shaped has to be heated to such a high temperature that the material becomes plastic. When the joined sheets have cooled, the result is a corrugated sheet material, which, e.g., may be used as roof or wall panels. The device and method according to US-A-4897146 works well for the intended purpose, but is less suitable for other purposes, e.g. for the manufacture of corrugated material for packing and the like.

10

THE INVENTION IN SUMMARY

An object of the invention is to provide a method for the manufacture of corrugated material of a plurality of material sheets, which are brought over core bars and heated and joined together in an effective way. An additional object is to provide a device for the manufacture of corrugated material of at least one first sheet and one second sheet. These objects are attained by the invention having received the features mentioned in claim 1 and claim 6, respectively.

According to the method, at least one sheet is heated at abutment against the core bars, the first and the second sheet abutting against each other at the heating

The device comprises heating members for the transfer of heat from the core bars to at least one sheet abutting against the core bars and comprising plastic material, and guide members for bringing together the first and the second sheet at the heating.

By the invention, the use of a plurality of different materials for the different layers in the corrugated product is enabled. Materials of different stiffness, toughness, friction and shock-absorption may, e.g., be chosen. The invention also enables a faster process start up without any extensive heating of drums or the like. A manufacturing process may also be finished faster and be temporarily stopped.

The finished product has a plurality of the advantages of the corrugated cardboard, such as very good insulating and shock-absorbing properties, but has in addition higher moist-resistance and durability. Furthermore, packages having been manufactured of the finished product may be spray
5 steam heated. Such packages neither emit dust particles. A material suitable in connection with the invention is blown polyethylene film with chalk as filler. For many applications, it is suitable with a film thickness in the range of 0,03-0,4 mm.

Packages and other products that have been produced according to
10 the invention are especially suitable in the food industry. Also in the pharmaceutical industry and the medical field, it may be advantageous to use the invention.

SHORT DESCRIPTION OF THE DRAWINGS

15

The invention will now be described closer by embodiment examples, reference being made to the accompanying drawings, where

- fig. 1 is a side view of an embodiment of the device according to the
20 invention,
- fig. 2 is a cross-sectional view, which shows how a corrugated material according to a first embodiment is produced,
- fig. 3 is a cross-sectional view, which shows how a corrugated material according to a second embodiment is produced,
- 25 fig. 4 is a cross-sectional view, which shows how a corrugated material according to a third embodiment is produced,
- fig. 5 is a cross-sectional view, which shows how a corrugated material according to a fourth embodiment is produced,
- 30 fig. 6 is a longitudinal section view from the line A-A in fig. 7 of member for corrugation of the material and

fig. 7 is a cross-sectional view from the line B-B in fig. 6 of the member in fig. 6.

THE INVENTION

5 Fig. 1 shows in principal how a manufacturing line, which operates according to the invention, may be made. A first part A, which is shown with dash and dot lines, comprises a first roll 10, a second roll 11 and a third roll 12, all winded up with a suitable sheet material, as well as conventional sheet stretching members 13. The different sheet materials are brought together in a second part B and form different layers of the finished corrugated material. It should be observed that material thickness, mutual distance between different components and other geometrical relations in fig. 1 as well as subsequent figures are not true to scale. A plurality of dimensions and distances have been changed in relation to real conditions in order to show features of the invention more clearly.

The elements that are included in part A may all be made according to prior art. However, it is important to notice that various sheet materials, both thickness and the material as such, may be arranged on the different rolls.

20 For most applications, it is suitable to use polyethylene (PE) and polypropylene (PP) with or without so called fillers. A suitable filler may be chalk.

Within the scope of the invention, entirely other materials may also be used. For instance, it is possible to use aluminum or other similar material in some layer in order to achieve high tightness against gas permeation. Materials that in itself cannot be heated together with the material of an adjacent sheet should be coated with or arranged next to a plastic layer.

25

The sheet or sheets 16 that are to be corrugated or formed in wave shape are preferably wider and rolled on wider rolls than other sheets, so that the finished corrugated material comprises equally wide layers. If the sheet 16 is narrower, it will be stretched during the corrugation. Before this sheet 16 is brought together with other sheets, it is suitably corrugated in a

30

corrugation device. In the embodiment shown, the corrugation device comprises an upper plate 14 and a lower plate 15, which is described closer reference being made to figs. 6 and fig. 7. An alternative embodiment of a corrugation device comprises two cylinders. In such an embodiment, it may be
5 suitable with pre-heating of the sheet 16 before the corrugation and then cooling of the sheet 16 afterwards.

After the corrugation device, the corrugated sheet 16 is led in between at least one set of upper core bars 17 and one set of lower core bars 18. These are described further below, reference being made to figs. 2-5. An
10 upper sheet 19 from the first roll 10 and a lower sheet 20 from the third roll 12 are brought together with the corrugated sheet 16 at the core bars 17 and 18. The core bars 17 and 18 extend in the common long direction V of the sheets, which is indicated at the corresponding arrow in fig. 1. In certain applications, the corrugation device may be omitted or be integrated with the
15 core bars. The two sets of core bars 17 and 18 are suspended behind or outside the sheets in a way not shown closer.

The sheets are heated by the core bars 17 and 18 and joined together to a corrugated sheet material through co-operation with an upper press roll 21 and a lower press roll 22. After the joining, the ready-formed sheet material is brought further in the direction of the arrow V in a conventional way by
20 an advancing upper driving roll 23 and an advancing lower driving roll 24. The upper press roll 21 and the lower press roll 22 may in some embodiments together advance the sheet material in a desired way. In such a case, the driving rolls 23 and 24 may be omitted.

25 The driving rolls 23 and 24 are included in a third part C, which in a conventional way may comprise at least one guide roller 25 and one cutting mechanism. In the embodiment shown, the cutting mechanism comprises an upper knife 26 and a lower knife 27 co-operating therewith. The knives 26 and 27 suitably move up and down and cut off the sheet material in sheets of
30 suitable length. Additional cutting devices cut the sheets to desired width. The size of the sheets is, to a large extent, dependent on the application for

which they are intended. The third part C constitutes not in itself part of the invention and may be given another design depending on the application in question.

5 In fig. 2, an example is shown of how the core bars may be arranged when a sheet material having three layers, one of which is corrugated, is to be produced. In this case, an upper line of core bars 17 is arranged with a certain mutual distance between adjacent core bars. A lower line of core bars 18 is arranged with the same mutual distance, but displaced in relation to the upper line, so that the space between the core bars is filled out with
10 space for an intermediate sheet of material.

All core bars have, in this embodiment, triangular cross-section, but other shapes may be chosen depending on the application in question. The sheet 16 that is to be corrugated runs between the upper line of core bars 17 and the lower line of core bars 18. The upper sheet 19 runs exactly above
15 the upper line of core bars 17 and will be pressed against the sheet 16 between the lower line of core bars 18 and the upper press roll 21. Correspondingly, the lower sheet 20 runs exactly below the lower line of core bars 18 and will be pressed against the sheet 16 between the upper line of core bars 17 and the lower press roll 22.

20 The pressure that is effected by the press rolls 21 and 22 may in an alternative embodiment be generated by difference in ambient pressure or by the fact that the material in the sheets is stretched in the latitudinal direction. In such a case, the press rolls 21 and 22 may be omitted. An additional alternative to the press rolls 21 and 22 may be reciprocating press plates.
25 The press plates are quickly brought towards the core bars and press together a portion of the sheets in the way described above during the phase when the sheets are welded together. Next, the press plates are retracted, so that the sheets may be fed forwards and a new portion of the sheets comes in the correct position for welding together.

30 At least parts of the portions of the core bars 17 and 18 which abut against the sheet 16 and/or the upper sheet 19 and/or the lower sheet 20 are

provided with heating members 28. By the heating members 28, heat is transferred to abutting and adjacent material sheets to such an extent that a joining of the sheets is achieved. The heating is local in smaller contact surfaces, which means that the desired temperature may be attained fast. In a preferred embodiment, the joining takes place in connection with the press rolls 21 and 22 driving the sheets forwards and, consequently, the sheets being in motion. In the other parts, the core bars 17 and 18 are not heated.

In a simple embodiment, the heating member 28 comprises electric heating conductors, which extend in the longitudinal direction of the core bars and which are supplied from conventional power supply units (not shown). It is also possible to transmit heat to abutting sheet portions in another way. The requisite energy may, e.g., be supplied to the contact surfaces through ultrasound, laser and other similar forms of energy permitting local or directed transmission of energy. The transmission of energy may also take place inductively or in a similar way and then be concentrated in the core bars 17 and 18, so that heating takes place locally.

As mentioned above, there may be different material compositions in the different sheets. Aluminium foil or a similar material may be used in some layer. In certain applications, it is suitable to use an intermediate layer, e.g. the sheet 16, with a lot of filler and two outer layers with less filler. Thereby, a sheet material is effected, which resists high load in the channel direction at the same time as the outer layers are very elastic. Such a sheet material is very suitable for use to packaging.

The material thickness may also vary in the different layers and according to the application in question. The sheet 16 that is to be corrugated may in that connection be made in a considerably thicker and stronger material than the other layers in order to obtain very good properties as for durability and impact resistance. In the same way, also other layers may be given desired properties as for, e.g., durability and impact resistance.

Fig. 3 shows an alternative embodiment with a third set of core bars 29 inserted between the upper line of core bars 17 and the lower line of core

bars 18. The third line of core bars 29 has a cross-section adapted to other core bars and is provided with a second set of heating members 28' and 28". In the embodiment shown, the core bars 29 are made with square cross-section. Also the sheet which is to be corrugated is doubled in an upper corrugation sheet 16 and a lower corrugation sheet 16'. The double heating members 28' and 28" enable, together with the heating members 28 of the upper core bars 17 and the lower core bars 18, the composition of a more complex sheet material. As is seen in fig. 3, the result is two outer plane layers and two inner corrugated layers.

Fig. 4 shows a simplified embodiment with only two material sheets. A lower sheet 20 is plane and a sheet 16 is corrugated in the same way as has been described above. In fig. 5, an alternative embodiment is shown with a first corrugated sheet 16 and a second corrugated sheet 16'. In other respects, the embodiments according to fig. 4 and fig. 5 equal the embodiments described above.

The section view in fig. 6 schematically shows how a device for corrugation of the sheet 16 may be made. A lower plate 15 is V-shaped with the sheet 16 moving towards the tip of the plate. The sheet 16 moves in the direction of the arrow V. The plate 15 is made with alternating v-shaped recesses and v-shaped ridges. The device for corrugation may be entirely omitted, if the resulting sheet material is not too wide. An upper plate 14 (see fig. 7) with a corresponding shape fits into the recesses and ridges, respectively, of the lower plate 15.

The embodiment of the device for corrugation is seen more clearly in fig. 7. The v-shaped recesses and ridges, respectively, are clearly shown in the figure. The shape of the recesses and of the ridges, respectively, is adapted to the shape of the core bars, so that the sheet is corrugated in the desired way, before it reaches the core bars. By virtue of the V-shape of the sheets 14 and 15, the sheet 16 will start to corrugate in a central portion. The sheet 16 is then corrugated outwards towards the sides from the central por-

tion as the sheet fed forwards. Thereby, too large a load on the sheet material during the corrugation process is avoided.

According to an alternative embodiment, the core bars are arranged in the same V-shape as the sheets 14 and 15 shown in fig. 6, which thereby
5 may be omitted.

CLAIMS

1. Method for the manufacture of corrugated material, at least one first plane
sheet (19; 20) and one second sheet (16) of plastic material arranged in
5 wave shape being brought together for adhesion to each other and the
wave-shaped sheet (16) running over core bars (17, 18),
characterized in

10 that a portion of at least one sheet is heated at abutment against the
core bars (17, 18) and

that the first sheet (19; 20) is brought to abutment against the second
sheet (16) for welding the sheets (16; 19, 20) together.

2. Method according to claim 1, wherein at least one portion of at
15 least one of the sheets (16; 19, 20) is heated directly in a contact surface
between adjacent sheets (16; 19, 20) with heating members (28) arranged in
the core bars (17, 18).

3. Method according to claim 1, wherein at least one portion of at
20 least one sheet is heated indirectly with heating members (28) arranged at a
distance from the core bars (17, 18).

4. Method according to claim 1, wherein the second sheet (16)
arranged in wave shape is corrugated before it reaches the core bars (17,
25 18).

5. Method according to claim 1, wherein the first sheet (19; 20) and
the second sheet (16) are pressed together against each other between a
line of core bars (17, 18) and at least one press roll (21; 22).

6. Device for the manufacture of corrugated material, first members being arranged for feeding at least one first plane sheet and one second sheet of plastic material arranged in wave shape and running over core bars (17, 18) and second members being arranged for bringing together and adhering the sheets, *characterized* in

that heating members (28) are arranged for transferring heat to a portion of at least one sheet (16; 19, 20) abutting against the core bars and including plastic material

that guide members (17, 18; 21; 22) are arranged for bringing together the first and the second sheet in an abutment portion and for welding together in the portion heated by the heating members (28).

15

7. Device according to claim 6, wherein the core bars (17, 18) comprise heating members (28) for direct heating of at least the sheet (16) which is corrugated.

20 8. Device according to claim 6, wherein heating members (28) are arranged at a distance from the core bars (17, 18) for transfer of energy to the abutment portion.

25 9. Device according to claim 6, wherein heating members (28) are arranged at a distance from the core bars (17, 18) for transfer of energy to the core bars (17, 18), so that the same are heated.

10. Device according to claim 6, wherein corrugation members (14; 15) are arranged for the corrugation of the second sheet (16), before the second sheet (16) reaches the core bars (17, 18).

5 11. Device according to claim 10, wherein the corrugation member (14; 15) comprise an upper plate (14) made with alternating recesses and ridges and a lower plate (15) made with alternating recesses and ridges adapted to the upper plate (14).

10 12. Device according to claim 6, wherein the core bars (17, 18) are made with a larger length in the central portion of the sheet and with a shorter length in the cross-direction of the sheet out from the central portion while forming the corrugation member (14; 15).

15 13. Device according to claim 6, wherein the core bars (17, 18) comprise electric resistance wire for heating material sheets (16; 19; 20) adjacent to the core bars (17, 18).

20 14. Device according to claim 6, wherein the core bars (17, 18) are arranged in an upper line (17) and a lower line (18).

15. Device according to claim 14, wherein at least a third set of core bars (29) are arranged in a line between the upper line (17) and the lower line (18).

1/2

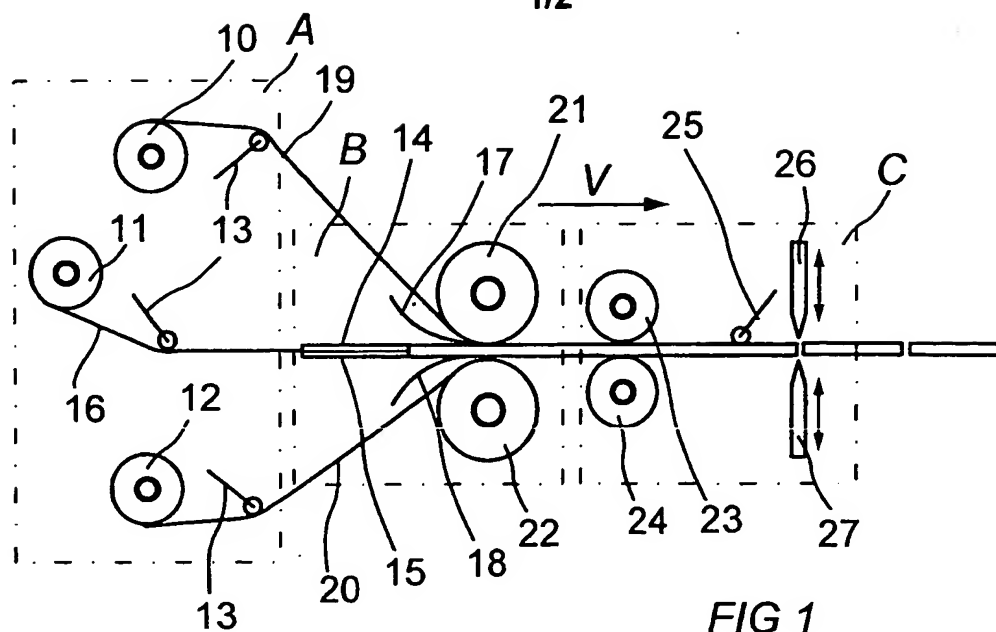


FIG 1

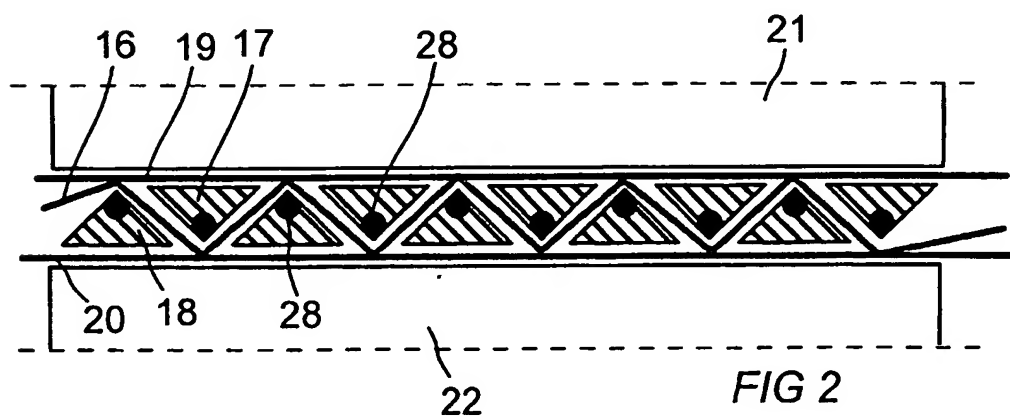


FIG 2

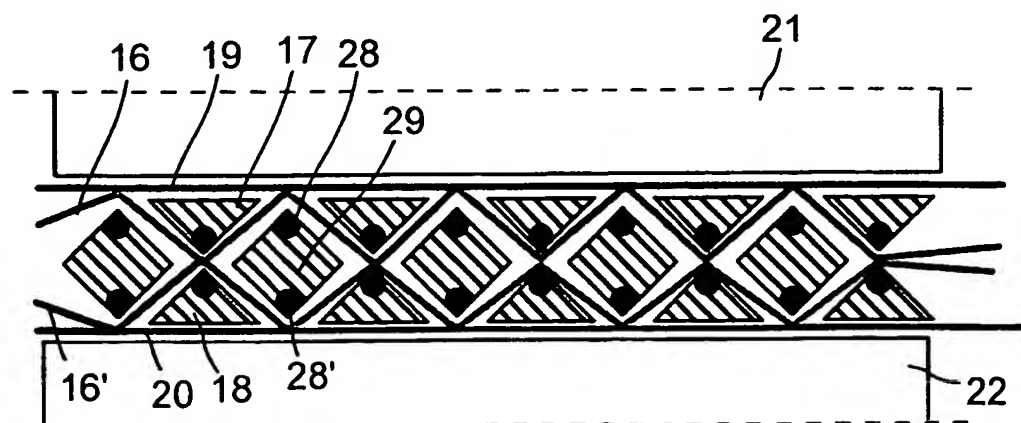
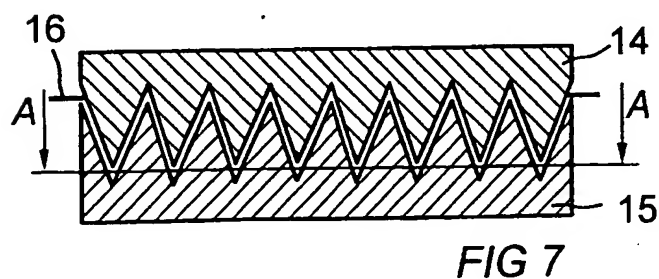
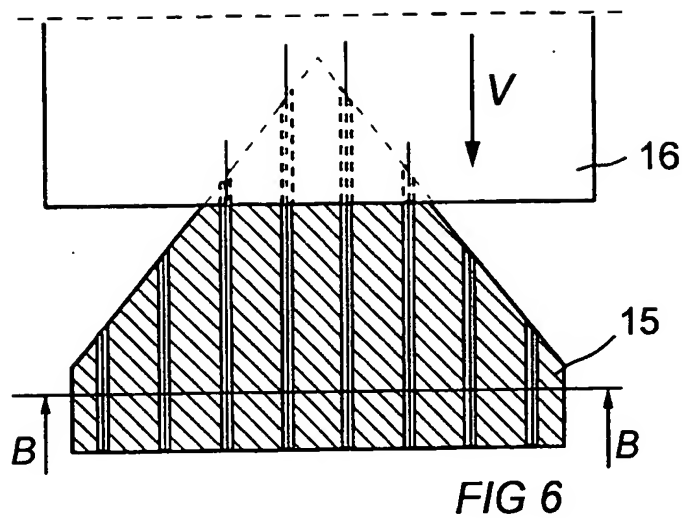
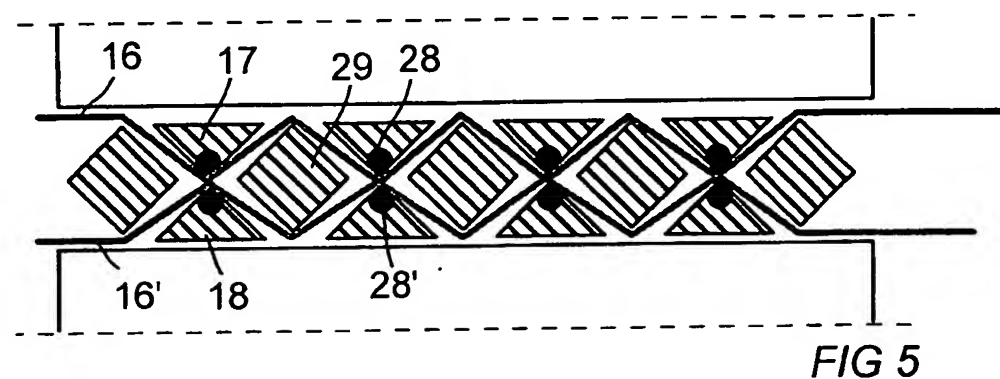
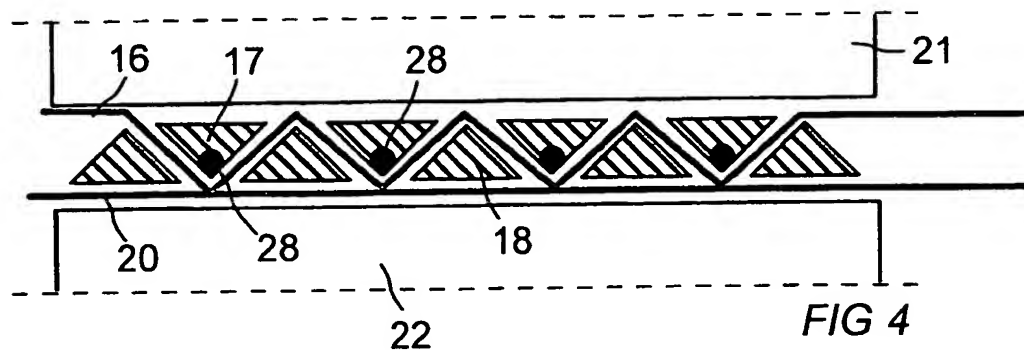


FIG 3

2/2



INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 00/01520

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: B32B 3/28, B29C 53/26

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: B32B, B29C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 3744952 A (JEAN FRANCOIS BEQUET ET AL), 10 July 1973 (10.07.73), column 2, line 60 - column 4, line 30 --	1-15
A	US 3666590 A (RINNOSUKE SUSUKI ET AL), 30 May 1972 (30.05.72), column 3, line 5 - line 60 --	1-15
A	US 4188253 A (HENRY D. SWARTZ), 12 February 1980 (12.02.80), column 6, line 9 - line 65, figure 1 --	1-15
A	FR 2088069 A (GUICHARD MAURICE), 7 January 1972 (07.01.72) --	1-15

☒ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

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Date of the actual completion of the international search

17 November 2000

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INTERNATIONAL SEARCH REPORT

International application No.

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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	FR 2081256 A (GUICHARD MAURICE), 3 December 1971 (03.12.71) --	1-15
A	US 4897146 A (LOUIS P. INZINNA), 30 January 1990 (30.01.90), figure 1, abstract, claims -- -----	1-15

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/SE 00/01520

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				US	4267223	A	12/05/81

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				EP	0325780	A,B	02/08/89
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PATENT COOPERATION TREATY

PCT

NOTIFICATION OF THE RECORDING
OF A CHANGE(PCT Rule 92bis.1 and
Administrative Instructions, Section 422)

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Date of mailing (day/month/year) 02 February 2001 (02.02.01)	IMPORTANT NOTIFICATION
Applicant's or agent's file reference P1741PC00	
International application No. PCT/SE00/01520	International filing date (day/month/year) 28 July 2000 (28.07.00)

1. The following indications appeared on record concerning:		
<input checked="" type="checkbox"/> the applicant	<input type="checkbox"/> the inventor	<input type="checkbox"/> the agent <input type="checkbox"/> the common representative
Name and Address WELLPLAST AB Erik Dahlbergsgatan 58 S-254 40 Helsingborg Sweden	State of Nationality SE	State of Residence SE
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2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:		
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4. A copy of this notification has been sent to:		
<input checked="" type="checkbox"/> the receiving Office	<input checked="" type="checkbox"/> the designated Offices concerned	
<input type="checkbox"/> the International Searching Authority	<input type="checkbox"/> the elected Offices concerned	
<input type="checkbox"/> the International Preliminary Examining Authority	<input type="checkbox"/> other:	

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No.: (41-22) 740.14.35	Authorized officer I. Britel Telephone No.: (41-22) 338.83.38
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PCT

**NOTICE INFORMING THE APPLICANT OF THE
COMMUNICATION OF THE INTERNATIONAL
APPLICATION TO THE DESIGNATED OFFICES**

(PCT Rule 47.1(c), first sentence)

From the INTERNATIONAL BUREAU

To:

HANSSON THYRESSON PATENTBYRÅ AB
Patent Dept.
Box 73
S-201 20 Malmö
SUÈDE

Date of mailing (day/month/year) 08 February 2001 (08.02.01)		
Applicant's or agent's file reference P1741PC00		IMPORTANT NOTICE
International application No. PCT/SE00/01520	International filing date (day/month/year) 28 July 2000 (28.07.00)	Priority date (day/month/year) 02 August 1999 (02.08.99)
Applicant WELLPLAST AB et al		

1. Notice is hereby given that the International Bureau has communicated, as provided in Article 20, the international application to the following designated Offices on the date indicated above as the date of mailing of this Notice:
AU, KP, KR, US

In accordance with Rule 47.1(c), third sentence, those Offices will accept the present Notice as conclusive evidence that the communication of the international application has duly taken place on the date of mailing indicated above and no copy of the international application is required to be furnished by the applicant to the designated Office(s).

2. The following designated Offices have waived the requirement for such a communication at this time:

AE, AG, AL, AM, AP, AT, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EA, EE, EP, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ, OA, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZW
The communication will be made to those Offices only upon their request. Furthermore, those Offices do not require the applicant to furnish a copy of the international application (Rule 49.1(a-bis)).

3. Enclosed with this Notice is a copy of the international application as published by the International Bureau on 08 February 2001 (08.02.01) under No. WO 01/08878

REMINDER REGARDING CHAPTER II (Article 31(2)(a) and Rule 54.2)

If the applicant wishes to postpone entry into the national phase until 30 months (or later in some Offices) from the priority date, a demand for international preliminary examination must be filed with the competent International Preliminary Examining Authority before the expiration of 19 months from the priority date.

It is the applicant's sole responsibility to monitor the 19-month time limit.

Note that only an applicant who is a national or resident of a PCT Contracting State which is bound by Chapter II has the right to file a demand for international preliminary examination.

REMINDER REGARDING ENTRY INTO THE NATIONAL PHASE (Article 22 or 39(1))

If the applicant wishes to proceed with the international application in the national phase, he must, within 20 months or 30 months, or later in some Offices, perform the acts referred to therein before each designated or elected Office.

For further important information on the time limits and acts to be performed for entering the national phase, see the Annex to Form PCT/IB/301 (Notification of Receipt of Record Copy) and Volume II of the PCT Applicant's Guide.

<p>The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland</p> <p>Facsimile No. (41-22) 740.14.35</p>	<p>Authorized officer</p> <p style="text-align: center;">J. Zahra</p> <p>Telephone No. (41-22) 338.83.38</p>
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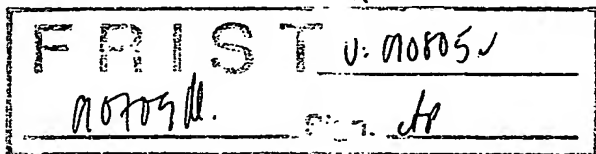
PATENT COOPERATION TREATY

ANKOM 2001 -07- 09

From the:
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To:

HANSSON THYRESSON PATENTBYRA AB
Box 73
S-201 20 Malmö
SUEDE



PCT

WRITTEN OPINION

(PCT Rule 66)

Applicant's or agent's file reference P1741PC00		Date of mailing (day/month/year)	05.07.2001
International application No. PCT/SE00/01520		International filing date (day/month/year)	28/07/2000
		Priority date (day/month/year)	02/08/1999
International Patent Classification (IPC) or both national classification and IPC B32B3/28			
Applicant WELLPLAST AB et al.			


- This written opinion is the **first** drawn up by this International Preliminary Examining Authority.
- This opinion contains indications relating to the following items:
 - I ☒ Basis of the opinion
 - II ☐ Priority
 - III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
 - IV ☐ Lack of unity of invention
 - V ☒ Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
 - VI ☐ Certain document cited
 - VII ☐ Certain defects in the international application
 - VIII ☐ Certain observations on the international application
- The applicant is hereby **invited to reply** to this opinion.

When? See the time limit indicated above. The applicant may, before the expiration of that time limit, request this Authority to grant an extension, see Rule 66.2(d).

How? By submitting a written reply, accompanied, where appropriate, by amendments, according to Rule 66.3. For the form and the language of the amendments, see Rules 66.8 and 66.9.

Also: For an additional opportunity to submit amendments, see Rule 66.4.
For the examiner's obligation to consider amendments and/or arguments, see Rule 66.4 bis.
For an informal communication with the examiner, see Rule 66.6.

If no reply is filed, the international preliminary examination report will be established on the basis of this opinion.
- The final date by which the international preliminary examination report must be established according to Rule 69.2 is: **02/12/2001**.

Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer / Examiner Lindner, T
	Formalities officer (incl. extension of time limits) Hanrieder-Kreuzer, K Telephone No. +49 89 2399 8081



I. Basis of the opinion

1. With regard to the **elements** of the international application (Replacement *sheets which have been furnished to the receiving Office in response to an invitation under Article 14* are referred to in this opinion as "originally filed"):

Description, pages:

1-9 as originally filed

Claims, No.:

1-15 as originally filed

Drawings, sheets:

1/2-2/2 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:

WRITTEN OPINION

International application No. PCT/SE00/01520

☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	1,3-6,8-10,14 (no)
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Inventive step (IS)	Claims	11 (no)
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Industrial applicability (IA)	Claims	
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2. Citations and explanations
see separate sheet

Re Item I

Basis of the opinion

1. Reference is made to the following documents:
D1: US-A-3666590
D2: US-A-4188253
- 2.1 The application is concerned with a method for manufacturing a corrugated material (claims 1 to 5) and a device therefor (claims 6 to 15).
In the method, at least one plane sheet and a corrugated sheet of plastic material are brought into contact and the corrugated sheet runs over core bars.
The method is characterized in
that a portion of at least one sheet is heated at abutment against the core bars
and
that the first and second sheet brought to abutment for being welded together.
- 2.2 It is observed that although it is the second sheet (in wave shape) which runs over core bars (17, 18), either of the first and the second may be heated by the core bars.
- 2.3 Moreover, the relative arrangement of the components is not defined.
The flutes of the corrugated core may be aligned either parallel to the direction of conveyance of the sheet materials or transverse to it, e.g., by being formed from a roller equipped with either elongated protrusions parallel to its axis of rotation or radially extending protrusions or lands.
The latter embodiment is related to citation D2, the former one to citation D1.
- 2.4 In the context of the international application, the term "welding" is regarded to be tantamount to "heat bonding" or "thermobonding".
- 2.5 Claim 6 (device) reflects the components which are enumerated in claim 1 without adding a further relevant feature.
For either claim, the feature that heat is transferred from the core bars to a sheet of plastic materials is regarded to be decisive.

Re Item V

Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

3. The subject-matter of claims 1, 3, 4, 5 and claims 6, 8, 9, 10 and 14 is known from D1 (Art. 33(2) PCT).
- 3.1 Starting from the above considerations, Figure 1 of D1 discloses corrugation members 21 and 22 which form a corrugated core sheet which then is transmitted to bar-shaped backing members 31, 32, etc (cf. col.3, ll.30-46 and Fig. 3 and 4) and covered on each side with planar sheets which are welded to the corrugated core sheet in press device 5 by heating them with steel belts 51 (col.3, ll.47-62).
- 3.2 It is apparent that these heating members indirectly heat the second sheet (the corrugated core sheet) and do not directly heat it (present claim 2). Moreover, no heating means is foreseen in the bar-shaped backing members disclosed in D1 (present claims 2, 7 and 13).
- 3.3 According to D1, suitably shaped rollers induce the desired corrugation pattern, whereas present claim 11 envisages plates with alternating recesses and ridges.
- 3.4 By reference to Figures 1, 5, 7 and 9 and the description of various embodiments given in D2, the same conclusions as above can be drawn, except that in D2 the flutes of the corrugated core are arranged perpendicularly to the machine direction.

Miscellaneous

- 4.1 The Applicants are invited to submit arguments in favour of the presence of an inventive step (Art. 33(3) PCT) of the subject-matter of claims 2 and 7 which is regarded to represent the essence of the invention.
- 4.2 When drafting a revised set of claims, the present uncertainty as to the orientation of the corrugations of the core layer should be remedied.

PATENT COOPERATION TREATY

ANKOM 2001 10

From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To:

HANSSON THYRESSON PATENTBYRA AB
Box 73
S-201 20 Malmö
SUEDE

PCT

NOTIFICATION OF TRANSMITTAL OF
THE INTERNATIONAL PRELIMINARY
EXAMINATION REPORT
(PCT Rule 71.1)

Date of mailing
(day/month/year) 08.10.2001

Applicant's or agent's file reference
P1741PC00

IMPORTANT NOTIFICATION

International application No.
PCT/SE00/01520

International filing date (day/month/year)
28/07/2000

Priority date (day/month/year)
02/08/1999

Applicant
WELLPLAST AB et al.

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary examination report and its annexes, if any, established on the international application.
2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.
3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.

4. REMINDER

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices) (Article 39(1)) (see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

Name and mailing address of the IPEA/



European Patent Office
D-80298 Munich
Tel. +49 89 2399 - 0 Tx: 523656 epmu d
Fax: +49 89 2399 - 4465

Authorized officer

Ferro Vasconcelos, M

Tel. +49 89 2399-7095



PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference P1741PC00	FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/SE00/01520	International filing date (<i>day/month/year</i>) 28/07/2000	Priority date (<i>day/month/year</i>) 02/08/1999
International Patent Classification (IPC) or national classification and IPC B32B3/28		
Applicant WELLPLAST AB et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.


2. This REPORT consists of a total of 5 sheets, including this cover sheet.

☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 3 sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☐ Certain observations on the international application

Date of submission of the demand 20/02/2001	Date of completion of this report 08.10.2001
Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer Lindner, T Telephone No. +49 89 2399 8976



**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. PCT/SE00/01520

I. Basis of the report

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):

Description, pages:

1-9 as originally filed

Claims, No.:

1-15 with telefax of 03/09/2001

Drawings, sheets:

1/2,2/2 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. PCT/SE00/01520

☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-15.
	No:	Claims	

Inventive step (IS)	Yes:	Claims	1-15
	No:	Claims	

Industrial applicability (IA)	Yes:	Claims	1-15
	No:	Claims	

**2. Citations and explanations
see separate sheet**

Re Item I

Basis of the report

1. Reference is made to the following documents:

D1: US-A-3666590

D2: US-A-4188253

- 2.1 The application is concerned with a method for manufacturing a corrugated material (claims 1 to 5) and a device therefor (claims 6 to 15).
In the method, at least one plane sheet and a wave-shaped sheet of plastic material are brought into contact and the corrugated sheet runs over core bars.

The method is characterized in that

- the core bars extend in longitudinal direction of the wave-shaped sheet;
- a portion of at least one sheet is heated at abutment against the core bars;
- the first and second sheet are brought to abutment for being welded together;
- and
- energy is supplied locally to contact surfaces of abutting sheet portions.

The device of claim 6 comprises corresponding features which find support in the application documents as originally filed (Art. 34(2)(b) PCT).

- 2.2 In the context of the international application, the term "welding" is regarded to be tantamount to "heat bonding" or "thermobonding".
- 2.3 The core bars extend in the longitudinal direction of the corrugated sheet which is the direction of conveyance and for this reason the flutes of the corrugated core have to be aligned parallel to the direction of conveyance.

For the assessment of novelty and inventive step, the features that heat is locally transferred from the core bars and that the core bars extend in the longitudinal direction to a sheet of plastic materials is regarded to be decisive.

Re Item V

Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

3. The subject-matter of the claims is not disclosed in the citation (Art. 33(2) PCT).
- 3.1 Figure 1 of D1 discloses corrugation members 21 and 22 which form a corrugated core sheet which then is transmitted to bar-shaped backing members 31, 32, etc (cf. col.3, ll.30-46 and Fig. 3 and 4) and covered on each side with planar sheets which are welded to the corrugated core sheet in press device 5 by heating them with steel belts 51 (col.3, ll.47-62).
These heating members indirectly heat the second sheet (the corrugated core sheet) and do not supply heat locally.
Moreover, no heating means is foreseen in the bar-shaped backing members disclosed in D1 (present claims 2, 7 and 13).
- 3.2 By reference to Figures 1, 5, 7 and 9 and the description of various embodiments given in D2, it can be concluded that in D2 the flutes of the corrugated core are arranged perpendicularly to the machine direction, contrary to the requirement of each of present claims 1 and 6.
- 3.3 This arrangement supplies the heat necessary for welding at the position where it is required.
Thus, energy is saved and the material of the sheets is not exposed to undue heat stress (Art. 33(3) PCT).

CLAIMS

1. Method for the manufacture of corrugated material, at least one first plane sheet (19; 20) and one second sheet (16) of plastic material arranged in wave shape being brought together for adhesion to each other and the wave-shaped sheet (16) running over core bars (17, 18), *characterized* in

- that the core bars (17, 18) extend in the longitudinal direction of the wave-shaped sheet (16),
- 10 that a portion of at least one sheet is heated at abutment against the core bars (17, 18),
- that the first sheet (19; 20) is brought to abutment against the second sheet (16) for welding the sheets (16; 19, 20) together and
- that energy is supplied locally to contact surfaces of abutting sheet portions.
- 15

2. Method according to claim 1, wherein at least one portion of at least one of the sheets (16; 19, 20) is heated directly in a contact surface between adjacent sheets (16; 19, 20) with heating members (28) arranged in the core bars (17, 18).

20

3. Method according to claim 1, wherein at least one portion of at least one sheet is heated indirectly with heating members (28) arranged at a distance from the core bars (17, 18).

25

4. Method according to claim 1, wherein the second sheet (16) arranged in wave shape is corrugated before it reaches the core bars (17, 18).

5. Method according to claim 1, wherein the first sheet (19; 20) and the second sheet (16) are pressed together against each other between a line of core bars (17, 18) and at least one press roll (21; 22).

5 6. Device for the manufacture of corrugated material, first members being arranged for feeding at least one first plane sheet and one second sheet of plastic material arranged in wave shape and running over core bars (17, 18) and second members being arranged for bringing together and adhering the sheets, *characterized* in

10

that the core bars (17, 18) extend in the longitudinal direction of the wave-shaped sheet (16),

that heating members (28) are arranged for transferring heat locally to contact surfaces of a portion of at least one sheet (16; 19, 20) abutting against the core bars and including plastic material

15

that guide members (17, 18; 21; 22) are arranged for bringing together the first and the second sheet in an abutment portion and for welding together in the portion heated by the heating members (28).

20

7. Device according to claim 6, wherein the core bars (17, 18) comprise heating members (28) for direct heating of at least the sheet (16) which is corrugated.

25

8. Device according to claim 6, wherein heating members (28) are arranged at a distance from the core bars (17, 18) for transfer of energy to the abutment portion.

9. Device according to claim 6, wherein heating members (28) are arranged at a distance from the core bars (17, 18) for transfer of energy to the core bars (17, 18), so that the same are heated.

5 10. Device according to claim 6, wherein corrugation members (14; 15) are arranged for the corrugation of the second sheet (16), before the second sheet (16) reaches the core bars (17, 18).

10 11. Device according to claim 10, wherein the corrugation member (14; 15) comprise an upper plate (14) made with alternating recesses and ridges and a lower plate (15) made with alternating recesses and ridges adapted to the upper plate (14).

15 12. Device according to claim 6, wherein the core bars (17, 18) are made with a larger length in the central portion of the sheet and with a shorter length in the cross-direction of the sheet out from the central portion while forming the corrugation member (14; 15).

20 13. Device according to claim 6, wherein the core bars (17, 18) comprise electric resistance wire for heating material sheets (16; 19; 20) adjacent to the core bars (17, 18).

25 14. Device according to claim 6, wherein the core bars (17, 18) are arranged in an upper line (17) and a lower line (18).

 15. Device according to claim 14, wherein at least a third set of core bars (29) are arranged in a line between the upper line (17) and the lower line (18).

CLAIMS

1. Method for the manufacture of corrugated material, at least one first plane sheet (19; 20) and one second sheet (16) of plastic material arranged in wave shape being brought together for adhesion to each other and the wave-shaped sheet (16) running over core bars (17, 18), *characterized* in
5 that a portion of at least one sheet is heated at abutment against the core bars (17, 18) and
that the first sheet (19; 20) is brought to abutment against the second sheet (16) for welding the sheets (16; 19, 20) together.
2. Method according to claim 1, wherein at least one portion of at least one of the sheets (16; 19, 20) is heated directly in a contact surface between adjacent sheets (16; 19, 20) with heating members (28) arranged in the core bars (17, 18).
3. Method according to claim 1, wherein at least one portion of at least one sheet is heated indirectly with heating members (28) arranged at a distance from the core bars (17, 18).
4. Method according to claim 1, wherein the second sheet (16) arranged in wave shape is corrugated before it reaches the core bars (17, 18).
5. Method according to claim 1, wherein the first sheet (19; 20) and the second sheet (16) are pressed together against each other between a line of core bars (17, 18) and at least one press roll (21; 22).
6. Device for the manufacture of corrugated material, first members being arranged for feeding at least one first plane sheet and one second sheet of plastic material arranged in wave shape and running over core bars (17, 18) and second members being arranged for bringing together and adhering the sheets,
5 *characterized* in
that heating members (28) are arranged for transferring heat to a portion of at least one sheet (16; 19, 20) abutting against the core bars and including plastic material

that guide members (17, 18; 21; 22) are arranged for bringing together the first and the second sheet in an abutment portion and for welding together in the portion heated by the heating members (28).

7. Device according to claim 6, wherein the core bars (17, 18) comprise heating members (28) for direct heating of at least the sheet (16) which is corrugated.

8. Device according to claim 6, wherein heating members (28) are arranged at a distance from the core bars (17, 18) for transfer of energy to the abutment portion.

9. Device according to claim 6, wherein heating members (28) are arranged at a distance from the core bars (17, 18) for transfer of energy to the core bars (17, 18), so that the same are heated.

10. Device according to claim 6, wherein corrugation members (14; 15) are arranged for the corrugation of the second sheet (16), before the second sheet (16) reaches the core bars (17, 18).

11. Device according to claim 10, wherein the corrugation member (14; 15) comprise an upper plate (14) made with alternating recesses and ridges and a lower plate (15) made with alternating recesses and ridges adapted to the upper plate (14).

12. Device according to claim 6, wherein the core bars (17, 18) are made with a larger length in the central portion of the sheet and with a shorter length in the cross-direction of the sheet out from the central portion while forming the corrugation member (14; 15).

13. Device according to claim 6, wherein the core bars (17, 18) comprise electric resistance wire for heating material sheets (16; 19; 20) adjacent to the core bars (17, 18).

14. Device according to claim 6, wherein the core bars (17, 18) are arranged in an upper line (17) and a lower line (18).

15. Device according to claim 14, wherein at least a third set of core bars (29) are arranged in a line between the upper line (17) and the lower line (18).

PCT REQUEST

Original (for SUBMISSION) - printed on 27.07.2000 05:21:38 PM

P1741PC00

0 0-1	For receiving Office use only International Application No.	PCT/ SE 0 0 / 0 1 5 2 0
0-2	International Filing Date	2 8 -07- 2000
0-3	Name of receiving Office and "PCT International Application"	<div style="border: 1px solid black; padding: 2px;">The Swedish Patent Office PCT International Application</div>
0-4 0-4-1	Form - PCT/RO/101 PCT Request Prepared using	PCT-EASY Version 2.90 (updated 08.03.2000)
0-5	Petition The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty	
0-6	Receiving Office (specified by the applicant)	Swedish Patent Office (RO/SE)
0-7	Applicant's or agent's file reference	P1741PC00
I	Title of invention	METHOD AND DEVICE FOR PRODUCING CORRUGATED PLASTIC MATERIAL
II II-1 II-2 II-4 II-5	Applicant This person is: Applicant for Name Address:	applicant only all designated States except US WELLPLAST AB Erik Dahlbergsgatan 58 S-254 40 HELSINGBORG Sweden
II-6	State of nationality	SE
II-7	State of residence	SE
III-1 III-1-1 III-1-2 III-1-4 III-1-5	Applicant and/or inventor This person is: Applicant for Name (LAST, First) Address:	applicant and inventor US only JÖNSSON, Anders Erik Dahlbergsgatan 58 S-254 40 HELSINGBORG Sweden
III-1-6	State of nationality	SE
III-1-7	State of residence	SE

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2/4

PCT REQUEST

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V	Designation of States	
V-1	Regional Patent (other kinds of protection or treatment, if any, are specified between parentheses after the designation(s) concerned)	AP: GH GM KE LS MW SD SL SZ TZ UG ZW and any other State which is a Contracting State of the Harare Protocol and of the PCT EA: AM AZ BY KG KZ MD RU TJ TM and any other State which is a Contracting State of the Eurasian Patent Convention and of the PCT EP: AT BE CH&LI CY DE DK ES FI FR GB GR IE IT LU MC NL PT SE and any other State which is a Contracting State of the European Patent Convention and of the PCT OA: BF BJ CF CG CI CM GA GN GW ML MR NE SN TD TG and any other State which is a member State of OAPI and a Contracting State of the PCT

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3/4

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V-2	National Patent (other kinds of protection or treatment, if any, are specified between parentheses after the designation(s) concerned)	AE AG AL AM AT AU AZ BA BB BG BR BY CA CH&LI CN CR CU CZ DE DK DM DZ EE ES FI GB GD GE GH GM HR HU ID IL IN IS JP KE KG KP KR KZ LC LK LR LS LT LU LV MA MD MG MK MN MW MX NO NZ PL PT RO RU SD SE SG SI SK SL TJ TM TR TT TZ UA UG US UZ VN YU ZA ZW	
V-5	Precautionary Designation Statement In addition to the designations made under items V-1, V-2 and V-3, the applicant also makes under Rule 4.9(b) all designations which would be permitted under the PCT except any designation(s) of the State(s) indicated under item V-6 below. The applicant declares that those additional designations are subject to confirmation and that any designation which is not confirmed before the expiration of 15 months from the priority date is to be regarded as withdrawn by the applicant at the expiration of that time limit.		
V-6	Exclusion(s) from precautionary designations	NONE	
VI-1	Priority claim of earlier national application		
VI-1-1	Filing date	02 August 1999 (02.08.1999)	
VI-1-2	Number	9902826-8	
VI-1-3	Country	SE	
VI-2	Priority document request The receiving Office is requested to prepare and transmit to the International Bureau a certified copy of the earlier application(s) identified above as item(s):	VI-1	
VII-1	International Searching Authority Chosen	Swedish Patent Office (ISA/SE)	
VII-2	Request to use results of earlier search; reference to that search		
VII-2-1	Date	02 August 1999 (02.08.1999)	
VII-2-2	Number	9902826-8	
VII-2-3	Country (or regional Office)	SE	
VIII	Check list	number of sheets	electronic file(s) attached
VIII-1	Request	4 ✓	-
VIII-2	Description	8 ✓	-
VIII-3	Claims	3 ✓	-
VIII-4	Abstract	1 ✓	p1741pc00absse.txt
VIII-5	Drawings	2 ✓	-
VIII-7	TOTAL	18	
VIII-8	Accompanying items	paper document(s) attached	electronic file(s) attached
VIII-8	Fee calculation sheet	✓	-
VIII-16	PCT-EASY diskette	-	diskette
VIII-18	Figure of the drawings which should accompany the abstract	2	
VIII-19	Language of filing of the international application	Swedish	

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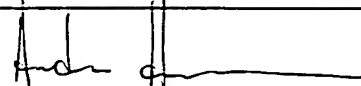
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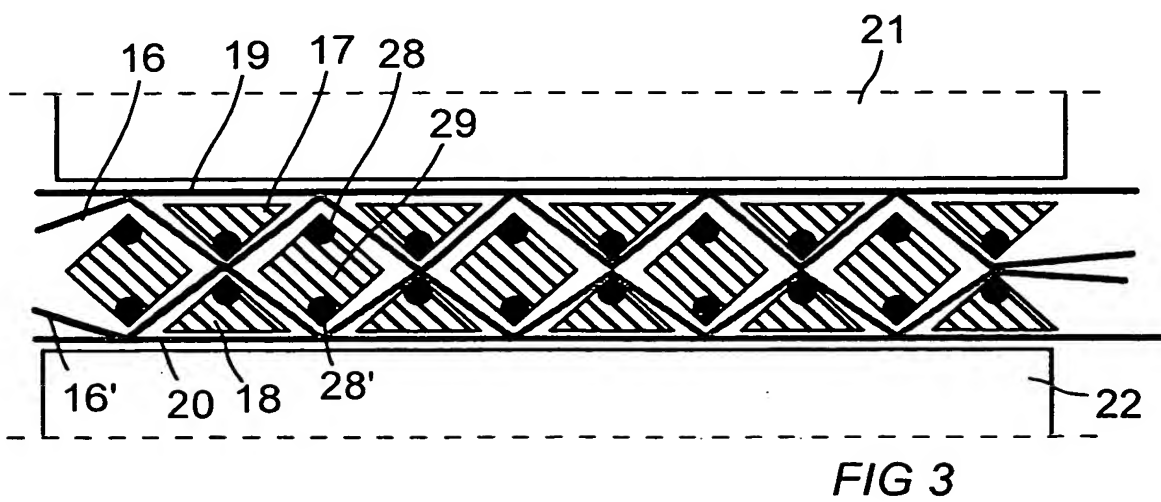
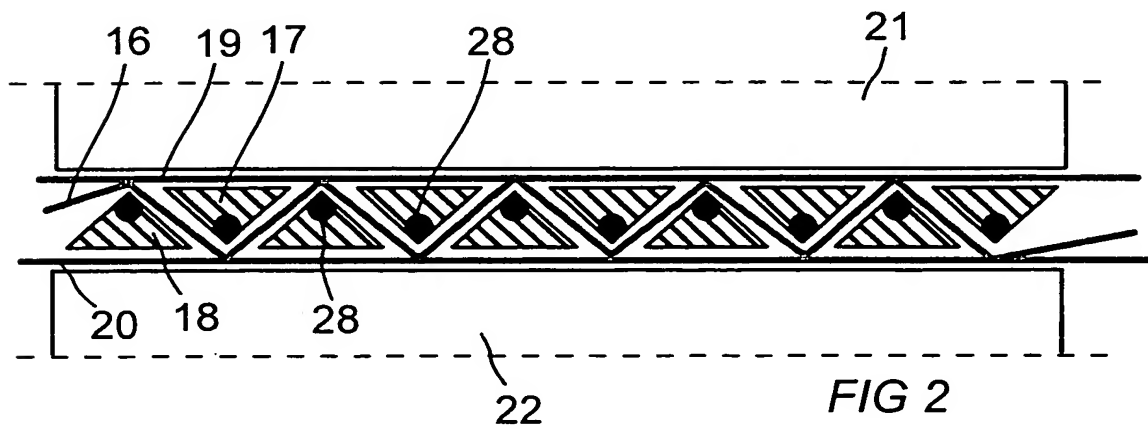
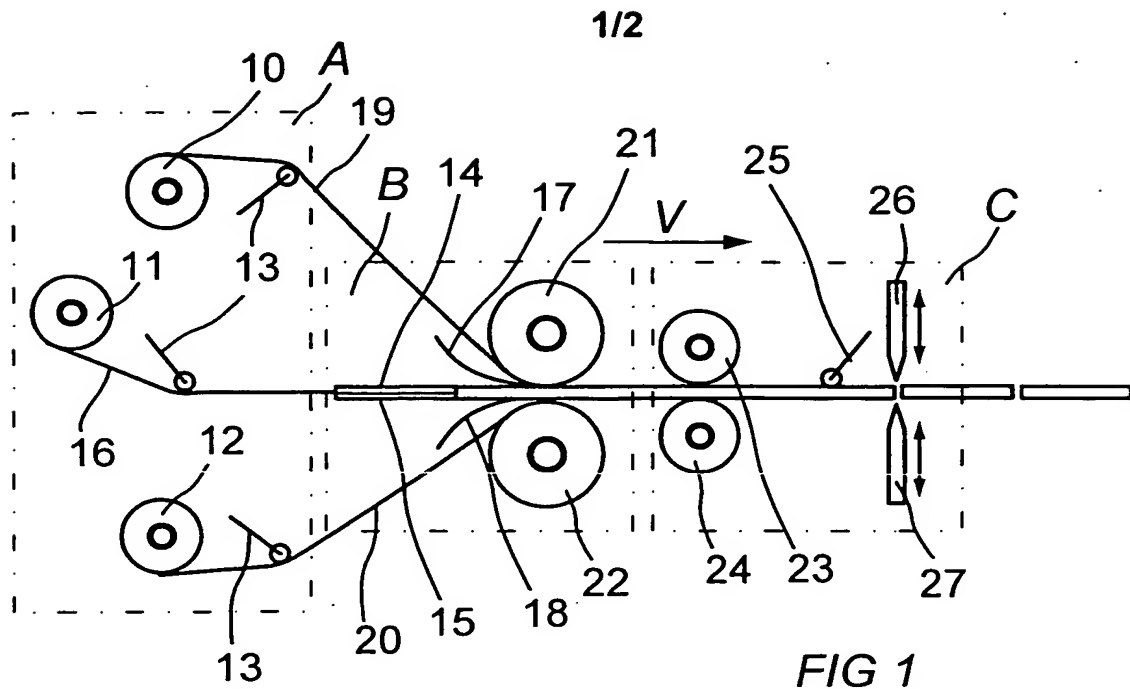
IX-1	Signature of applicant or agent	
IX-1-1	Name	HANSSON THYRESSON PATENTBYRÅ AB
IX-1-2	Name of signatory	Anders Hansson

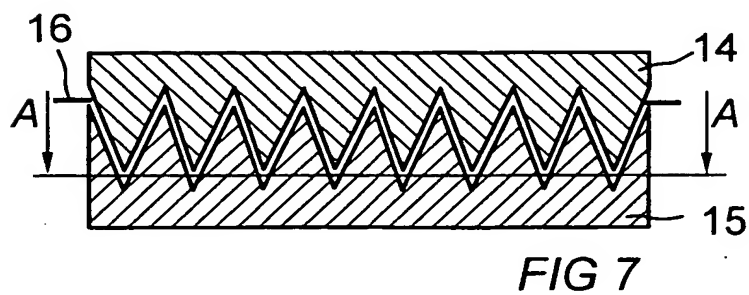
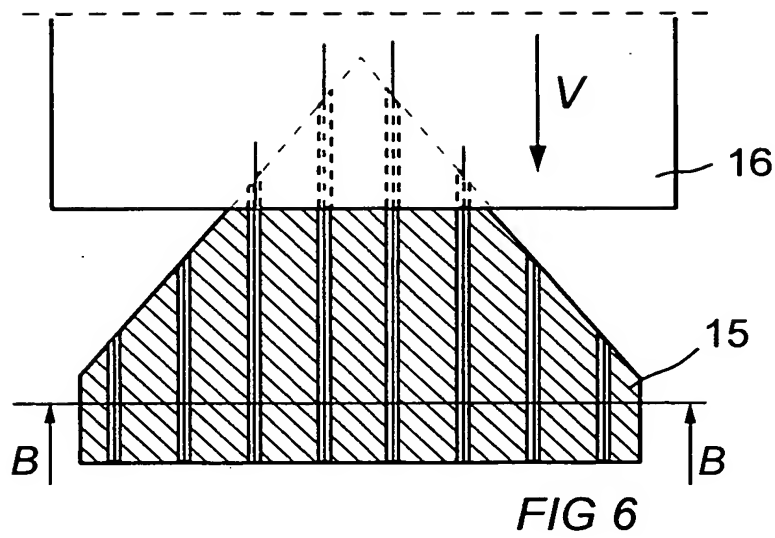
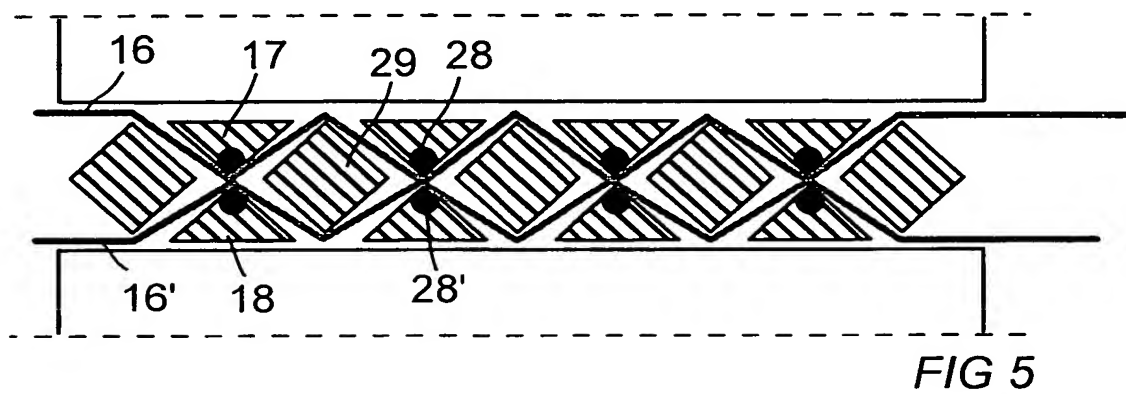
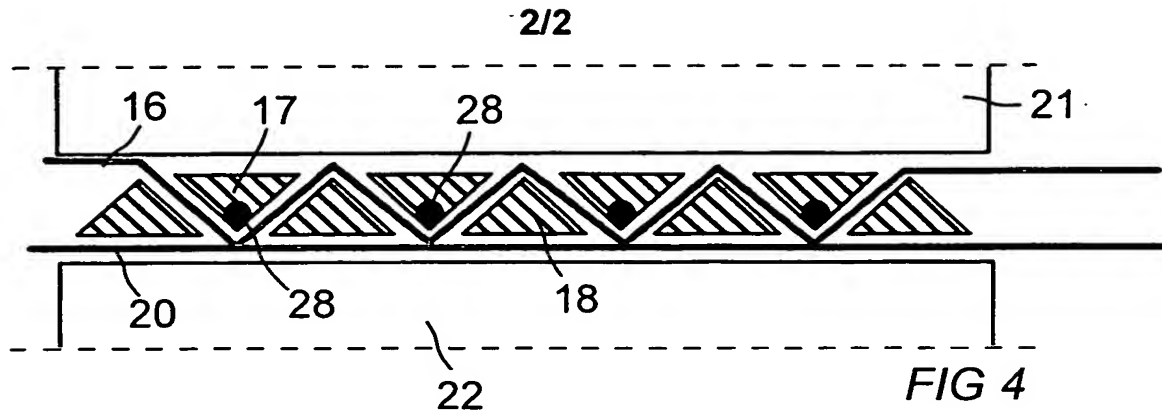
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10-1	Date of actual receipt of the purported international application	
10-2	Drawings:	
10-2-1	Received	
10-2-2	Not received	
10-3	Corrected date of actual receipt due to later but timely received papers or drawings completing the purported international application	
10-4	Date of timely receipt of the required corrections under PCT Article 11(2)	
10-5	International Searching Authority	ISA/SE
10-6	Transmittal of search copy delayed until search fee is paid	

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11-1	Date of receipt of the record copy by the International Bureau	18 AUGUST 2000	(18.08.00)
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METOD OCH ANORDNING FÖR TILLVERKNING AV KORRUGERAT MATERIAL

UPPFINNINGSSOMRÅDET

5

Uppfinningen avser metod och anordning för tillverkning av korrugerat material, varvid åtminstone en första plan bana och en andra i vågform ordnad bana av plastmaterial sammanförs för vidhäftning till varandra och varvid den vågformade banan löper över domstänger. Första organ är anordnade för frammatning av åtminstone en plan bana och en andra över domstängerna löpande bana av plastmaterial och andra organ är anordnade för sammanföring och vidhäftning av banorna.

10

TEKNIKENS STÅNDPUNKT

15

Sedan lång tid har olika former av wellpapp tillverkats och använts framför allt för emballage och liknande. Wellpapp har mycket goda isolerande och stötupptagande egenskaper, men lider också av flera nackdelar. Den kanske största nackdelen är dess dåliga fukttålighet. När wellpapp blir fuktig, förlorar den stor del av sin bärförmåga och sin hållbarhet.

20

Det är också i och för sig känt att forma banor av plastmaterial till vågform och sammanbinda sådana vågformade banor med plana banor av liknande material. Ett exempel på detta visas och beskrivs i US-A-4897146. Den bana som ska vågformas värms upp av särskilda uppvärmningsorgan, så att materialet blir plastiskt. Materialet formas därefter till vågform med domstänger och en sida av det vågformade materialet pressas mot en i förväg uppvärmd plan bana av en formtrumma, vilken är utförd med ringformade och till domstängerna anpassade urtagningar. Ytterligare en plan bana värms upp på liknande sätt och pressas mot det vågformade materialets andra sida av en andra företrädesvis kyld trumma.

25

30

Det material som banorna är utförda av är förhållandevis styvt och banornas tjocklek är sådan att åtminstone den bana som ska vågformas måste värmas upp till så hög temperatur att materialet blir plastiskt. Efter det att de sammanfogade banorna har svalnat blir resultatet ett korrugerat skivmaterial,

som t ex kan användas som tak- eller väggskivor. Anordningen och sättet enligt US-A-4897146 fungerar väl för det tänkta ändamålet, men är mindre lämpligt för andra ändamål, t ex för tillverkning av korrugerat material för emballage och liknande.

5

UPPFINNINGEN I SAMMANFATTNING

10 Ett syfte med uppfinningen är att åstadkomma en metod för tillverkning av korrugerat material av flera materialbanor, vilka förs över dornstänger och på ett effektivt sätt värms och sammanfogas. Ytterligare ett syfte är att åstadkomma en anordning för tillverkning av korrugerat material av åtminstone en första bana och en andra bana. Dessa syften uppnås genom att uppfinningen erhållit de i patentkravet 1 respektive patentkravet 6 angivna särdragen.

15 I enlighet med metoden uppvärms åtminstone en bana vid anliggning mot dornstängerna, varvid den första banan och den andra banan anligger mot varandra vid uppvärmningen

Anordningen innefattar uppvärmningsorgan för överföring av värme från dornstängerna till åtminstone en mot dornstängerna anliggande och plastmaterial innefattande bana samt styrorgan för sammanföring av den första banan och den andra banan vid uppvärmningen.

20 Genom uppfinningen möjliggörs användning av flera olika material till de olika skikten i de korrugerade produkten. T.ex. kan material av olika styvhet, seghet, friktion och stötdämpning väljas. Uppfinningen möjliggör också snabbare processtart utan omfattande uppvärmning av trummor eller liknande. En tillverkningsprocess kan också avslutas snabbare och stoppas tillfälligt.

30 Den färdiga produkten har flera av wellpapprets fördelar, som mycket goda isolerande och stötupptagande egenskaper, men har därtill högre fuktållighet och hållbarhet. Vidare kan förpackningar, som tillverkats av den färdiga produkten, ångsteriliseras. Sådan förpackningar avger inte heller dammpartiklar. Ett i samband med uppfinningen lämpligt material är blåst

polyetenfilm med krita som fyllnadsmedel. För många tillämpningar är det lämpligt med en filmtjocklek i storleksordningen 0,03-0,4 mm.

Förpackningar och andra produkter som framställts i enlighet med uppfinningen är särskilt lämpliga inom livsmedelsindustrin. Även inom läke-
5 medelsindustrin och sjukvårdsområdet kan det vara fördelaktigt att använda uppfinningen.

KORT BESKRIVNING AV RITNINGARNA

10 Uppfinningen ska nu närmare beskrivas med hjälp av utföringsexempel under hänvisning till bifogade ritningar, på vilka

- fig. 1 är en sidovy av ett utförande av anordningen enligt uppfinningen,
fig. 2 är en tvärsektionsvy, som visar hur ett korrugerat material enligt
15 ett första utförande framställs,
fig. 3 är en tvärsektionsvy, som visar hur ett korrugerat material enligt ett andra utförande framställs,
fig. 4 är en tvärsektionsvy, som visar hur ett korrugerat material enligt ett tredje utförande framställs,
20 fig. 5 är en tvärsektionsvy, som visar hur ett korrugerat material enligt ett fjärde utförande framställs,
fig. 6 är en längdsektionsvy från linjen A-A i fig. 7 av organ för veckning av materialet och
fig. 7 är en tvärsektionsvy från linjen B-B i fig. 6 av organet i fig. 6.

25

UPPFINNINGEN

Fig. 1 visar principiellt hur en tillverkningslinje, som arbetar i enlighet med uppfinningen, kan vara utförd. En första del A, som visas med prick-
30 streckade linjer, innefattar en första rulle 10, en andra rulle 11 och en tredje rulle 12, alla upprullade med lämpligt banmaterial, samt konventionella ban-spänningsorgan 13. De olika banmaterialen förs i en andra del B samman och bildar olika skikt hos det färdiga korrugerade materialet. Det bör observe-

ras att materialtjocklekar, inbördes avstånd mellan olika komponenter och andra geometriska förhållanden i såväl fig. 1 som efterföljande figurer inte är skalenliga. Flera dimensioner och avstånd har förändrats i förhållande till verkliga omständigheter för att tydligare visa särdrag hos uppfinningen.

- 5 De element som ingår i del A kan alla vara utförda i enlighet med känd teknik. Det är dock viktigt att notera att olika banmaterial, både tjocklek och material som sådant, kan anordnas på de olika rullarna. För de flesta tillämpningar är det lämpligt att använda polyetylen (PE) och polypropylen (PP) med eller utan så kallade fyllnadsmedel. Lämpligt fyllnadsmedel kan vara krita.
- 10 Inom ramen för uppfinningen kan också helt andra material användas. Det är t.ex. möjligt att i något skikt använda aluminium eller annat liknande material för att uppnå hög täthet mot gasgenomsläppning. Material som i sig själv inte kan värmas ihop med materialet hos en intilliggande bana bör vara belagt med eller anordnas intill ett plastskikt.
- 15 De eller de banor 16 som ska veckas eller formas i vågform är företrädesvis bredare och rullade på bredare rullar än övriga banor, så att det färdiga korrugerade materialet innefattar lika breda skikt. Om banan 16 är smalare, kommer den att sträckas under veckningen. Innan denna bana 16 sammanförs med övriga banor, veckas den lämpligen i en veckningsanordning. I
- 20 det visade utförandet innefattar veckningsanordningen en övre skiva 14 och en nedre skiva 15, vilka närmare beskrivs med hänvisning till fig. 6 och fig. 7. Ett alternativt utförande av en veckningsanordning innefattar två valsar. I ett sådant utförande kan det vara lämpligt med förvärmning av banan 16 före veckningen och därefter kylning av banan 16 efteråt.
- 25 Efter veckningsanordningen leds den veckade banan 16 in mellan åtminstone en uppsättning övre dornstänger 17 och en uppsättning nedre dornstänger 18. Dessa beskrivs ytterligare nedan med hänvisning till fig. 2-5. En övre bana 19 från den första rullen 10 och en nedre bana 20 från den tredje rullen 12 sammanförs med den veckade banan 16 vid dornstängerna
- 30 17 och 18. Dornstängerna 17 och 18 utsträcker sig i banornas gemensamma löpriktning V, som anges vid motsvarande pil i fig. 1. I vissa tillämpningar kan veckningsanordningen utgå eller vara integrerad med dornstängerna. De

båda uppsättningarna dornstänger 17 och 18 är upphängda bakom eller utanför banorna på inte närmare visat sätt.

5 Banorna värms genom dornstängerna 17 och 18 och sammanfogas till ett korrugerat skivmaterial genom samverkan med en övre tryckvals 21 och en nedre tryckvals 22. Efter sammanfogningen förs det färdigformade skiv-
10 materialet vidare i pilens V riktning på konventionellt sätt genom en framdrivande övre drivvals 23 och en framdrivande nedre drivvals 24. Den övre tryckvalsen 21 och den nedre tryckvalsen 22 kan i vissa utföranden tillsammans driva skivmaterialet framåt på önskat sätt. I sådana fall kan drivvalsarna 23 och 24 utgå.

Drivvalsarna 23 och 24 ingår i en tredje del C, vilken på konventionellt sätt kan innefatta åtminstone en styrrulle 25 och en skärmekanism. I det visade utförandet innefattar skärmekanismen en övre kniv 26 och en med denna samverkande nedre kniv 27. Knivarna 26 och 27 rör sig lämpligen upp
15 och ner och skär av skivmaterialet i skivor av lämplig längd. Ytterligare skär-
anordningar skär skivorna till önskad bredd. Skivornas storlek är i hög grad beroende av vilken tillämpning de är aktuella för. Den tredje delen C utgör inte i sig del i uppfinningen och kan ges annan utformning i beroende av aktuell tillämpning.

20 I fig. 2 visas ett exempel på hur dornstängerna kan anordnas då ett skivmaterial med tre skikt, varav ett veckat, ska framställas. I detta fall är en övre rad dornstänger 17 anordnade med visst inbördes avstånd mellan närliggande dornstänger. En undre rad dornstänger 18 är anordnade med samma inbördes avstånd, men förskjutet i förhållande till den övre raden, så att
25 utrymmet mellan dornstängerna fylls ut med utrymme för en mellanliggande materialbana.

Samtliga dornstänger har i detta utförande triangulär tvärsektion, men andra former kan väljas i beroende av aktuell tillämpning. Den bana 16 som ska veckas löper mellan den övre raden dornstänger 17 och den undre raden
30 dornstänger 18. Den övre banan 19 löper just ovanför den övre raden dornstänger 17 och kommer att pressas mot banan 16 mellan den undre raden dornstänger 18 och den övre tryckvalsen 21. På motsvarande sätt löper den

nedre banan 20 just under den undre raden dornstänger 18 och kommer att pressas mot banan 16 mellan den övre raden dornstänger 17 och den undre tryckvalsens 22.

5 Det tryck som åstadkoms genom tryckvalsarna 21 och 22 kan i ett alternativt utförande alstras genom skillnad i omgivningstryck eller genom att materialet i banorna sträcks i tvärriktningen. I sådana fall kan tryckvalsarna 21 och 22 utgå. Ytterligare ett alternativ till tryckvalsarna 21 och 22 kan vara fram- och återgående tryckplattor. Tryckplattorna förs snabbt in mot dornstängerna och pressar samman ett parti av banorna på ovan angivet sätt under den fas då banorna svetsas samman. Därefter dras tryckplattorna åter
10 bort, så att banorna kan matas fram och ett nytt parti av banorna kommer i rätt läge för sammansvetsning.

Åtminstone delar av de partier hos dornstängerna 17 och 18 som anligger mot banan 16 och/eller den övre banan 19 och/eller den nedre banan
15 20 är försedda med uppvärmningsorgan 28. Genom uppvärmningsorganen 28 överförs värme till anliggande och intilliggande materialbanor i sådan omfattning att en sammanfogning av banorna åstadkoms. Uppvärmningen är lokal i mindre anliggningsytor, vilket innebär att önskad temperatur kan uppnås snabbt. I ett föredraget utförande sker sammanfogningen i samband med
20 att tryckvalsarna 21 och 22 driver banorna framåt och banorna således är i rörelse. I övriga delar är dornstängerna 17 och 18 inte uppvärmda.

I ett enkelt utförande innefattar uppvärmningsorganet 28 elektriska värmetrådar, som utsträcker sig i dornstängernas längdriktning och som matas från konventionella strömförsörjningsaggregat (ej visade). Det är också
25 så möjligt att överföra värme till anliggande banpartier på annat sätt. T.ex. kan erforderlig energi tillföras anliggningsytorna genom ultraljud, laser och andra liknande energiformer som medger lokal eller riktad energiöverföring. Energiöverföringen kan också ske induktivt eller på liknande sätt och därvid koncentreras i dornstängerna 17 och 18, så att uppvärmningen sker lokalt.

30 Som nämnts ovan kan olika materialsammansättningar i de olika banorna förekomma. Aluminiumfolie eller liknande material kan användas i något skikt. I vissa tillämpningar är det lämpligt att använda ett mittlager, t.ex.

banan 16, med mycket fyllnadsmedel och två yttre skikt med mindre fyllnadsmedel. Därigenom åstadkoms ett skivmaterial, som tål hög belastning i kanalriktningen samtidigt som de yttre skikten är mycket elastiska. Ett sådant skivmaterial är mycket lämpligt för användning till emballage.

5 Även materialtjockleken kan variera i de olika skikten och efter aktuell tillämpning. Den bana 16 som ska veckas kan därvid utföras i betydligt tjockare och starkare material än övriga skikt för att uppnå mycket goda egenskaper vad avser hållbarhet och slagtlighet. På samma sätt kan även övriga skikt ges önskade egenskaper vad avser t.ex. hållbarhet och slagtlighet.

10 Fig. 3 visar ett alternativt utförande med en tredje uppsättning dornstänger 29 inskjuten mellan den övre raden dornstänger 17 och den nedre raden dornstänger 18. Den tredje raden dornstänger 29 har en tvärsektion som är anpassad till övriga dornstänger och är försedd med en andra uppsättning uppvärmningsorgan 28' och 28". I det visade utförandet är dornstängerna 29 utförda med kvadratisk tvärsektion. Även den bana som ska
15 veckas är dubblerad i en övre veckningsbana 16 och en undre veckningsbana 16'. De dubbla uppvärmningsorganen 28' och 28" möjliggör tillsammans med uppvärmningsorganen 28 hos de övre dornstängerna 17 och de nedre dornstängerna 18 sammansättning av ett mer komplext skivmaterial. Som
20 framgår av fig. 3, blir resultatet två yttre plana skikt och två inre veckade skikt.

Fig. 4 visar ett förenklat utförande med endast två materialbanor. En nedre bana 20 är plan och en bana 16 veckas på samma sätt som beskrivits ovan. I fig. 5 visas ett alternativt utförande med en första veckad bana 16 och
25 en andra veckad bana 16'. I övrigt motsvarar utförandena i enlighet med fig. 4 och fig. 5 de ovan beskrivna utförandena.

Sektionsvyn i fig. 6 visar schematiskt hur en anordning för veckning av banan 16 kan vara utförd. En nedre skiva 15 är V-formad med banan 16 rörande sig i mot spetsen hos skivan. Banan 16 rör sig i pilens V riktning.
30 Skivan 15 är utförd med omväxlande v-formade urtag och v-formade åsar. Anordningen för veckning kan helt utgå, om det resulterande skivmaterialet

inte är alltför brett. En övre skiva 14 (se fig. 7) med motsvarande form passar in i urtagen respektive åsarna hos den nedre skivan 15.

Utförandet av anordningen för veckning framgår tydligare av fig. 7. De v-formade urtagen respektive åsarna visas tydligt på figuren. Urtagens respektive åsarnas form är anpassad till dornstängernas form, så att banan
5 veckas på önskat sätt, innan den når dornstängerna. Genom att skivorna 14 och 15 V-form kommer banan 16 att börja veckas i ett centralt parti. Banan 16 veckas därefter ut åt sidorna från det centrala partiet allt eftersom banan frammatas. Därigenom undviks alltför stor belastning på banmaterialet under
10 veckningsprocessen.

Enligt ett alternativt utförande anordnas dornstängerna i samma V-form som de i fig. 6 visade skivorna 14 och 15, vilka därigenom kan utgå.

PATENTKRAV

1. Metod för tillverkning av korrugerat material, varvid åtminstone en första plan bana (19; 20) och en andra i vågform ordnad bana (16) av plastmaterial
5 sammanförs för vidhäftning till varandra och varvid den vågformade banan (16) löper över dornstänger (17, 18), *k ä n n e t e c k n a d* av
- att ett parti hos åtminstone en bana uppvärms vid anliggning mot dornstängerna (17, 18) och
- 10 att den första banan (19; 20) bringas till anliggning mot den andra banan (16) för sammansvetsning av banorna (16; 19, 20).
2. Metod enligt krav 1, varvid åtminstone ett parti hos åtminstone en av banorna (16; 19, 20) uppvärms direkt i en anliggningsyta mellan intilliggande
15 banor (16; 19, 20) med i dornstängerna (17, 18) anordnade uppvärmningsorgan (28).
3. Metod enligt krav 1, varvid åtminstone ett parti hos åtminstone en bana uppvärms indirekt med på avstånd från dornstängerna (17, 18) anordnade
20 uppvärmningsorgan (28).
4. Metod enligt krav 1, varvid den andra i vågform ordnade banan (16) veckas innan den når dornstängerna (17, 18).
- 25 5. Metod enligt krav 1, varvid den första banan (19; 20) och den andra banan (16) sammanpressas mot varandra mellan en rad dornstänger (17, 18) och åtminstone en tryckvals (21; 22).
- 30 6. Anordning för tillverkning av korrugerat material, varvid första organ är anordnade för frammatning av åtminstone en första plan bana och en andra i vågform ordnad och över dornstänger (17, 18) löpande bana av plastmaterial och andra organ är anordnade för sammanföring och vidhäftning av banorna, *k ä n n e t e c k n a d* av

- att uppvärmningsorgan (28) är anordnade för överföring av värme till ett parti hos åtminstone en mot domstängerna anliggande och plastmaterial innefattande bana (16; 19, 20) och
- 5 att styrorgan (17, 18; 21; 22) är anordnade för sammanföring av den första banan och den andra banan i ett anliggningsparti och för sammansvetsning i det av uppvärmningsorganen (28) uppvärmda partiet.
7. Anordning enligt krav 6, varvid domstängerna (17, 18) innefattar uppvärmningsorgan (28) för direkt uppvärmning av åtminstone den bana (16) som är veckad.
- 10
8. Anordning enligt krav 6, varvid uppvärmningsorgan (28) är anordnade på avstånd från domstängerna (17, 18) för överföring av energi till anliggningspartiet.
- 15
9. Anordning enligt krav 6, varvid uppvärmningsorgan (28) är anordnade på avstånd från domstängerna (17, 18) för överföring av energi till domstängerna (17, 18), så att dessa uppvärms.
- 20
10. Anordning enligt krav 6, varvid veckningsorgan (14; 15) är anordnade för veckning av den andra banan (16), innan den andra banan (16) når domstängerna (17, 18).
- 25
11. Anordning enligt krav 10, varvid veckningsorganet (14; 15) innefattar en med omväxlande urtagningar och åsar utförd övre skiva (14) och en till den övre skivan (14) anpassad med omväxlande urtagningar och åsar utförd nedre skiva (15).
- 30
12. Anordning enligt krav 6, varvid domstängerna (17, 18) är utförda med större längd i banans centrala parti och med kortare längd i banans tvärriktning ut från det centrala partiet under bildande av veckningsorganet (14; 15).

13. Anordning enligt krav 6, varvid domstängerna (17, 18) innefattar elektrisk motståndstråd för uppvärmning av intill domstängerna (17, 18) liggande materialbanor (16; 19; 20).

5 14. Anordning enligt krav 6, varvid domstängerna (17, 18) är anordnade i en övre rad (17) och en nedre rad (18).

10 15. Anordning enligt krav 14, varvid åtminstone en tredje uppsättning domstänger (29) är anordnad i en rad mellan den övre raden (17) och den nedre raden (18).

SAMMANDRAG

- Metod och anordning för tillverkning av korrugerat material, varvid åtminstone en första plan bana (19; 20) och en andra i vågform ordnad bana (16) av plastmaterial sammanförs för vidhäftning till varandra och varvid den vågformade banan (16) löper över dornstänger (17, 18). Ett parti hos åtminstone en bana uppvärms vid anliggning mot dornstängerna (17, 18) och den första banan (19; 20) bringas till anliggning mot den andra banan (16) för sammansvetsning av banorna (16; 19, 20).
- Första organ är anordnade för frammatning av åtminstone den första plana banan och den andra över dornstänger (17, 18) löpande banan av plastmaterial och andra organ är anordnade för sammanföring och vidhäftning av banorna. Uppvärmningsorgan (28) är anordnade för överföring av värme till ett parti hos åtminstone en mot dornstängerna anliggande och plastmaterial innefattande bana (16; 19, 20). Vidare är styrorgan (17, 18; 21; 22) anordnade för sammanföring av den första banan och den andra banan i ett anliggningsparti och för sammansvetsning i det av uppvärmningsorganen (28) uppvärmda partiet.

10/031956

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PCT Chapter II

Att:

International Application No. PCT/SE00/01520
WELLPLAST AB et al.

1. With reference to the Written Opinion of 05.07.2001 a set of amended claims is filed as replacement pages* 10-12. Also enclosed is a set of claims* indicating all amendments made.

1.1 In claim 1 the following amendments have been made:

a) The wording "the core bars (17, 18) extend in the longitudinal direction of the wave-shaped sheet (16)" has been included. The amendment is fully supported in the description, page 5, line 12-13. This is clear also from the drawings, c.f. Fig. 1, Fig. 2 and Fig. 6.

531 Rec'd PCT/PTC 22 JAN 2002

- 1.2 In claim 6 amendments corresponding to the amendments made to claim 1 have been made.
2. With reference to **Item I** the following comments are made.
- 2.1 It is stated in the written opinion that the relative arrangement of the components used in accordance with the invention is defined. It is believed that this objection has been overcome by the amendments of the independent claims. The claims now on file clearly defines that the core bars extend in the longitudinal direction (and thereby in the direction of movement) of the sheets. In the written opinion reference has been made to US3666590 (D1) and US4188253 (D2).
- 2.2 D1 discloses a method for manufacture of corrugated synthetic resin sheet. A press device comprises upper and lower Teflon coated steel belts that are advanced at the same speed as a corrugated sheet. The press device also comprises suitable heating means which heat the upper and lower steel belts so that planar sheets on either side of the corrugated sheet may be welded to the corrugated sheet from both sides thereof along lines of contact.
- 2.3 D1 clearly is directed to a system in which heat is supplied to an outside of outer planar sheet. A novel sheet material that can be plastically deformed at room temperature is preferably used according to D1. A hot-melt type adhesive normally has to be supplied to achieve the bonding between the sheets. If a hot-melt adhesive is not used it is required that the temperature of the outer planar sheet is raised to the melting temperature of the sheet material. The supply of energy also has to be sufficient to transfer heat to the apexes of the corrugated sheet, so as to melt or weld them together with the outer sheet. There also has to be a pressure from the conveyors advancing the outer sheet to press the sheet together in the welding areas. The complete outer sheets will be heated. As a result the core bars will melt into, cut and adhere to the melted outer sheets in those positions where the core bars

engage the outer sheets. Thus, a hot-melt adhesive having a lower melting temperature than sheet material is required in practise to make the method functional.

- 2.4 The present invention is novel over D1 because in accordance with D1 heat is supplied from the outside through an outer planar sheet to a corrugated sheet. In accordance with the claimed invention heat is supplied locally to contact surfaces of abutting sheet portions. As a result no hot-melt adhesive is required to weld the different sheets together. Another advantage that is achieved by using the claimed invention is that the total energy consumption for heating and welding will be significantly reduced, most likely to a third of the energy consumption in the prior art systems.
- 2.5 D2 relates to a machine for the fabrication of plastic board from one corrugated sheet and at least one face sheet. The sheets are fed from source rolls over endless conveyers. A closed loop of heating means, each heating means extending in the latitudinal direction of the sheets, keeps pace with the sheets. The heating means engages the corrugations of the corrugated sheet and maintains core material in continuous motion with the face material. The claimed invention is novel over the disclosure of D2 because the machine in D2 does not include any core bars extending in the longitudinal direction of the sheets.
3. Applicant does not agree with the conclusion in paragraph 3 of Item V. The subject-matter of amended claims 1 and 6 is known neither from D1 nor from D2. In D1 no heat is transferred locally to contact surfaces of abutting sheets. In D2 a conveyor having heating means extending in the transverse direction of the feeding direction of the sheet is used.
- 3.1 Starting from D1 a problem of the method disclosed therein in relation to the claimed invention is that heat is applied over a large area. If the sheets are thin such a wide application of heat may result in broken or damaged sheets. A person skilled in the art turning to D2 for solving this problem would be taught to move away from longitudinally extending core bars and instead, in accordance with D2, introduce an endless conveyor having heat-

ing means extending in the transverse direction. Thus, the claimed invention involves an inventive step.

- 3.2 Starting from D2 a problem of the machine disclosed therein in relation to the claimed invention is that the machine is complicated and is provided with a plurality of moving parts that have to be co-ordinated. The device shown in D1 is more simple and would lead the skilled person to exchange the endless conveyor having heating means extending in the transverse direction with longitudinally extending simple core bars. However, the skilled person would find no guidance to provide a local heating at the core bars. Thus, the claimed invention involves an inventive step.
4. In summary, neither of the cited documents shows a device or a method for manufacture of corrugated material including longitudinally extending core bars and heating means that will supply heat locally to contact surfaces of abutting sheet portions. Starting from either one of the cited documents a skilled person would be taught to move away from the invention by including features from the other one. Thus the claimed invention is novel and involves an inventive step

Hansson Thyresson Patentbyrå AB



Anders Hansson

* Encl.

CLAIMS

1. Method for the manufacture of corrugated material, at least one first plane sheet (19; 20) and one second sheet (16) of plastic material arranged in wave shape being brought together for adhesion to each other and the wave-shaped sheet (16) running over core bars (17, 18), *characterized* in

- that the core bars (17, 18) extend in the longitudinal direction of the wave-shaped sheet (16),
- 10 that a portion of at least one sheet is heated at abutment against the core bars (17, 18),
- that the first sheet (19; 20) is brought to abutment against the second sheet (16) for welding the sheets (16; 19, 20) together and
- that energy is supplied locally to contact surfaces of abutting sheet portions.
- 15

2. Method according to claim 1, wherein at least one portion of at least one of the sheets (16; 19, 20) is heated directly in a contact surface between adjacent sheets (16; 19, 20) with heating members (28) arranged in the core bars (17, 18).

20

3. Method according to claim 1, wherein at least one portion of at least one sheet is heated indirectly with heating members (28) arranged at a distance from the core bars (17, 18).

25

4. Method according to claim 1, wherein the second sheet (16) arranged in wave shape is corrugated before it reaches the core bars (17, 18).

5. Method according to claim 1, wherein the first sheet (19; 20) and the second sheet (16) are pressed together against each other between a line of core bars (17, 18) and at least one press roll (21; 22).

5 6. Device for the manufacture of corrugated material, first members being arranged for feeding at least one first plane sheet and one second sheet of plastic material arranged in wave shape and running over core bars (17, 18) and second members being arranged for bringing together and adhering the sheets, *characterized* in

10

that the core bars (17, 18) extend in the longitudinal direction of the wave-shaped sheet (16),

that heating members (28) are arranged for transferring heat locally to contact surfaces of a portion of at least one sheet (16; 19, 20) abutting against the core bars and including plastic material

15

that guide members (17, 18; 21; 22) are arranged for bringing together the first and the second sheet in an abutment portion and for welding together in the portion heated by the heating members (28).

20

7. Device according to claim 6, wherein the core bars (17, 18) comprise heating members (28) for direct heating of at least the sheet (16) which is corrugated.

25

8. Device according to claim 6, wherein heating members (28) are arranged at a distance from the core bars (17, 18) for transfer of energy to the abutment portion.

9. Device according to claim 6, wherein heating members (28) are arranged at a distance from the core bars (17, 18) for transfer of energy to the core bars (17, 18), so that the same are heated.

5 10. Device according to claim 6, wherein corrugation members (14; 15) are arranged for the corrugation of the second sheet (16), before the second sheet (16) reaches the core bars (17, 18).

10 11. Device according to claim 10, wherein the corrugation member (14; 15) comprise an upper plate (14) made with alternating recesses and ridges and a lower plate (15) made with alternating recesses and ridges adapted to the upper plate (14).

15 12. Device according to claim 6, wherein the core bars (17, 18) are made with a larger length in the central portion of the sheet and with a shorter length in the cross-direction of the sheet out from the central portion while forming the corrugation member (14; 15).

20 13. Device according to claim 6, wherein the core bars (17, 18) comprise electric resistance wire for heating material sheets (16; 19; 20) adjacent to the core bars (17, 18).

 14. Device according to claim 6, wherein the core bars (17, 18) are arranged in an upper line (17) and a lower line (18).

25

 15. Device according to claim 14, wherein at least a third set of core bars (29) are arranged in a line between the upper line (17) and the lower line (18).

To show amendments made

CLAIMS

1. Method for the manufacture of corrugated material, at least one first plane sheet (19; 20) and one second sheet (16) of plastic material arranged in wave shape being brought together for adhesion to each other and the wave-shaped sheet (16) running over core bars (17, 18), *characterized* in

that the core bars (17, 18) extend in the longitudinal direction of the wave-shaped sheet (16).

that a portion of at least one sheet is heated at abutment against the core bars (17, 18) and 18).

that the first sheet (19; 20) is brought to abutment against the second sheet (16) for welding the sheets (16; 19, 20) together together and

that energy is supplied locally to contact surfaces of abutting sheet portions.

2. Method according to claim 1, wherein at least one portion of at least one of the sheets (16; 19, 20) is heated directly in a contact surface between adjacent sheets (16; 19, 20) with heating members (28) arranged in the core bars (17, 18).

3. Method according to claim 1, wherein at least one portion of at least one sheet is heated indirectly with heating members (28) arranged at a distance from the core bars (17, 18).

4. Method according to claim 1, wherein the second sheet (16) arranged in wave shape is corrugated before it reaches the core bars (17, 18).

5. Method according to claim 1, wherein the first sheet (19; 20) and the second sheet (16) are pressed together against each other between a line of core bars (17, 18) and at least one press roll (21; 22).

To show amendments made

6. Device for the manufacture of corrugated material, first members being arranged for feeding at least one first plane sheet and one second sheet of plastic material arranged in wave shape and running over core bars (17, 18) and second members being arranged for bringing together and adhering the sheets, *characterized* in

that the core bars (17, 18) extend in the longitudinal direction of the wave-shaped sheet (16).

that heating members (28) are arranged for transferring heat locally to contact surfaces of a portion of at least one sheet (16; 19, 20) abutting against the core bars and including plastic material

that guide members (17, 18; 21; 22) are arranged for bringing together the first and the second sheet in an abutment portion and for welding together in the portion heated by the heating members (28).

7. Device according to claim 6, wherein the core bars (17, 18) comprise heating members (28) for direct heating of at least the sheet (16) which is corrugated.

8. Device according to claim 6, wherein heating members (28) are arranged at a distance from the core bars (17, 18) for transfer of energy to the abutment portion.

9. Device according to claim 6, wherein heating members (28) are arranged at a distance from the core bars (17, 18) for transfer of energy to the core bars (17, 18), so that the same are heated.

10. Device according to claim 6, wherein corrugation members (14; 15) are arranged for the corrugation of the second sheet (16), before the second sheet (16) reaches the core bars (17, 18).

11. Device according to claim 10, wherein the corrugation member (14; 15) comprise an upper plate (14) made with alternating recesses and ridges and a lower plate (15) made with alternating recesses and ridges adapted to the upper plate (14).

To show amendments made

12. Device according to claim 6, wherein the core bars (17, 18) are made with a larger length in the central portion of the sheet and with a shorter length in the cross-direction of the sheet out from the central portion while forming the corrugation member (14; 15).
13. Device according to claim 6, wherein the core bars (17, 18) comprise electric resistance wire for heating material sheets (16; 19; 20) adjacent to the core bars (17, 18).
14. Device according to claim 6, wherein the core bars (17, 18) are arranged in an upper line (17) and a lower line (18).
15. Device according to claim 14, wherein at least a third set of core bars (29) are arranged in a line between the upper line (17) and the lower line (18).

INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 00/01520

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: B32B 3/28, B29C 53/26

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: B32B, B29C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 3744952 A (JEAN FRANCOIS BEQUET ET AL), 10 July 1973 (10.07.73), column 2, line 60 - column 4, line 30 --	1-15
A	US 3666590 A (RINOSUKE SUSUKI ET AL), 30 May 1972 (30.05.72), column 3, line 5 - line 60 --	1-15
A	US 4188253 A (HENRY D. SWARTZ), 12 February 1980 (12.02.80), column 6, line 9 - line 65, figure 1 --	1-15
A	FR 2088069 A (GUICHARD MAURICE), 7 January 1972 (07.01.72) --	1-15



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents

"A" document defining the general state of the art which is not considered to be of particular relevance

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Date of the actual completion of the international search

17 November 2000

Date of mailing of the international search report

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 00/01520

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	FR 2081256 A (GUICHARD MAURICE), 3 December 1971 (03.12.71) --	1-15
A	US 4897146 A (LOUIS P. INZINNA), 30 January 1990 (30.01.90), figure 1, abstract, claims -- -----	1-15

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/SE 00/01520

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				CA	940668	A	29/01/74
				CH	540102	A	28/09/73
				DE	2061500	A,B,C	08/07/71
				ES	386883	A	16/04/73
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				NL	167352	B,C	16/07/81
				NL	7018120	A	02/07/71
				NO	133262	B,C	29/12/75
				SE	368528	B	08/07/74
				ZA	7007932	A	25/08/71

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				US	4267223	A	12/05/81

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				EP	0325780	A,B	02/08/89
				JP	1280555	A	10/11/89

PATENT COOPERATION TREATY

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NOTIFICATION OF ELECTION

(PCT Rule 61.2)

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Date of mailing (day/month/year) 08 May 2001 (08.05.01)	Applicant's or agent's file reference P1741PC00
International application No. PCT/SE00/01520	Priority date (day/month/year) 02 August 1999 (02.08.99)
International filing date (day/month/year) 28 July 2000 (28.07.00)	
Applicant JÖNSSON, Anders et al	

1. The designated Office is hereby notified of its election made:

☒ in the demand filed with the International Preliminary Examining Authority on:
 20 February 2001 (20.02.01)

☐ in a notice effecting later election filed with the International Bureau on:

2. The election ☒ was
☐ was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No.: (41-22) 740.14.35	Authorized officer Claudio Borton Telephone No.: (41-22) 338.83.38
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